

# ASSOCIATION BETWEEN BACKPAIN & BACKPACK WEIGHT AMONG SCHOOL GOING CHILDREN AGED BETWEEN 10 TO 14 YEARS IN LAHORE

*Original Research*

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## ABSTRACT

**Background:** Back pain, particularly affecting the lower ribs and gluteal area, is prevalent among adolescents, with rates ranging from 11% to 52.1%. Low back pain has become a major health concern, often leading to musculoskeletal issues at an early age. School backpacks are known contributors to lumbar discomfort due to increased weight from academic materials. Ergonomic factors, weight distribution, and posture while carrying bags play essential roles in back pain among school-going children.

**Objective:** To assess the association between back pain and backpack weight among school children aged 10 to 14 years in Lahore.

**Methods:** This cross-sectional study was conducted from March to July 2022, involving 385 students aged 10-14 from three private schools in Lahore. Inclusion criteria required students to have no physical deformities. Ethical clearance was obtained (No. HCHS/2022/ERC/026-27). Data were analyzed using SPSS version 25.0, with descriptive statistics calculated for frequencies, percentages, mean, standard deviation, and range. The chi-square test was applied to assess the association between back pain and backpack weight, with significance set at  $p < 0.05$ .

**Results:** The average age of participants was  $12.56 \pm 1.683$  years, with 62.4% females and 37.6% males. Schools in urban areas accounted for 93.2% of participants, while 6.8% were from rural areas. Among the students, 27.2% carried light bags (2-4 kg), 64.4% carried medium bags (4-6 kg), and 8.4% carried heavy bags (6-10 kg). Daily travel time to school was under 10 minutes for 30.8%, 10-20 minutes for 48.0%, 21-25 minutes for 19.2%, 26-30 minutes for 1.6%, and over 30 minutes for 0.4%. Notably, 62.4% of students sometimes experienced back pain, with heavy backpacks significantly associated with higher pain levels ( $p = 0.015$ ).

**Conclusion:** Heavy backpacks are a prominent factor in low back pain among school children, exacerbating strain on the shoulders and back. Further research using diverse observational methods is recommended to explore practical solutions for reducing backpack-related musculoskeletal strain in children.

**Keywords:** Adolescents, Back pain, Backpacks, Cross-sectional studies, Ergonomics, Musculoskeletal pain, Posture.

## INTRODUCTION

Back pain, particularly affecting the lower ribs and gluteal area, is a prevalent concern among adolescents, impacting between 11% to 52.1% of teens and pre-teens. Low back pain, the most frequent type, is increasingly recognized as a significant health issue that can lead to musculoskeletal disorders at an early age(1). The daily use of backpacks, often filled with substantial academic materials, has contributed to a notable rise in the incidence of back pain in students, as heavy backpack weights commonly strain the lower back muscles. Although backpacks are designed to be worn over both shoulders, some styles—such as hand-held bags and asymmetrically worn straps—can cause unequal weight distribution, thereby imposing stress on the back and shoulder muscles, especially when posture is compromised(2-4). Specific types of bags, like roller bags, can also induce lower back strain due to altered posture during use. Research suggests that 10% to 40% of teens report that low back pain limits their everyday activities, and it has been observed that low back pain during childhood may be an indicator of similar issues persisting into adulthood(5-7). Despite its impact, few studies have employed validated, standardized questionnaires to assess the relationship between back pain and the quality of life in children, leaving a gap in understanding their general health status and the specific physical discomforts they experience(8, 9).

As the physical demands on children evolve with increased mobility and academic requirements, the need to study these factors becomes more pressing. In countries like Malaysia, there is a notable lack of comprehensive data on adolescent back pain, reflecting an urgent need for further study, particularly among age-consistent groups for streamlined sampling and analysis(10-12). In the United States alone, over 40 million students carry school supplies in backpacks, raising widespread concerns over the potential health risks associated with this daily load. Muscular imbalances can result from asymmetrical bag straps, especially when straps are too short, causing uneven weight distribution and postural challenges(13, 14). These postural strains are particularly concerning among younger, less active students who may still be in key stages of bone development. Not only are early primary school students largely unaware of postural health risks, but even those who understand the ergonomics of backpack use may find it challenging to implement them due to the time required for the central nervous system to adapt to proper posture(15, 16). Children's physical development is impacted by numerous factors upon entering school age, including decreased physical activity, heavy school bags, and asymmetrical backpack strap use, all of which increase the load on their developing bodies(17, 18). It is thus essential to investigate the link between backpack usage and back pain among schoolchildren to inform future policies that can reduce these physical burdens and ultimately improve children's quality of life(19, 20). This study aims to assess the association between back pain and backpack weight in schoolchildren aged 10 to 14 years in Lahore(21, 22).

## METHODS

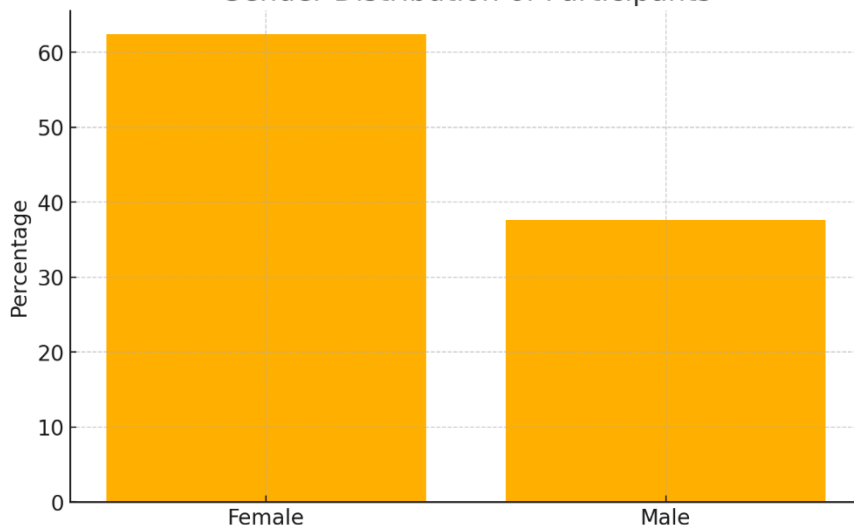
A cross-sectional study was conducted in three schools: Unique School System, American Lycetuff School, and Lahore Grammar School, all located in Lahore. Data collection occurred from March 2022 to July 2022 and involved a sample of 385 students who met specific inclusion criteria: ages 10-14 years, currently enrolled in a private sector school, and without any physical deformities. Ethical approval was secured from the Ethics Review Committee at Hussain College of Health Sciences, Lahore (No. HCHS/2022/ERC/026-27) prior to data collection. Data analysis was performed using the Statistical Package for Social Sciences (SPSS), version 25.0. Various statistical measures, including frequency distribution, percentage, mean, standard deviation, minimum and maximum range, were utilized to summarize the data descriptively. To assess the relationship between back pain and backpack weight, the chi-square test was applied, with statistical significance defined as a p-value of less than 0.05(23).

The selection of three distinct schools—Unique School System, American Lycetuff School, and Lahore Grammar School—was intended to capture a representative sample of private sector schoolchildren in Lahore, aged 10-14 years, for examining the association between backpack weight and back pain. These schools were chosen to reflect a diverse socio-economic background, as well as varying school sizes and academic demands, which can influence the types of backpacks used and the weight carried by students. Additionally, school policies on backpack usage and weight guidelines, if present, were considered to ensure that the findings would be generalizable across a broad spectrum of school environments. This selection approach aimed to enhance the study's applicability and relevance for potential interventions in similar educational settings(24).

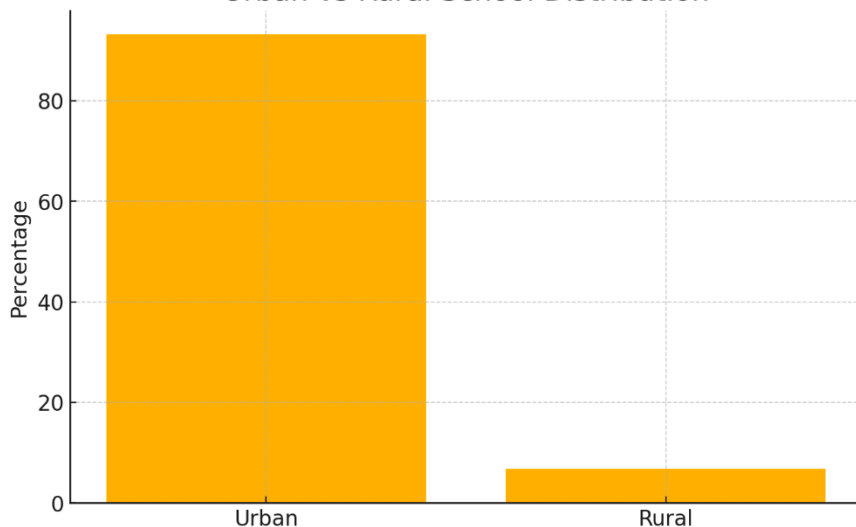
## RESULTS

The study analyzed data from 385 participants with an average age of  $12.56 \pm 1.683$  years, comprising 62.4% females and 37.6% males. Among the participants, 93.2% attended schools in urban areas, while 6.8% were enrolled in rural schools. The grade distribution included 0.4% in grade 3, 7.6% in grade 4, 13.2% in grade 5, 15.6% in grade 6, 20.8% in grade 7, 17.6% in grade 8, 10.4% in grade 9, 14.0% in grade 10, and 0.4% in grade 13.

Gender Distribution of Participants

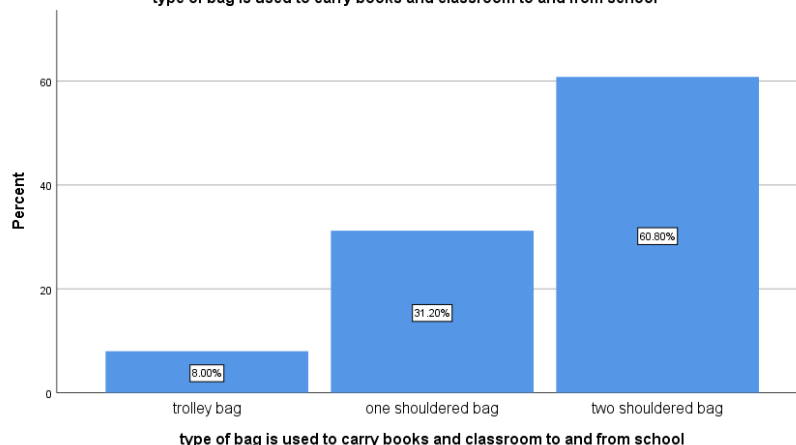


Urban vs Rural School Distribution



Regarding modes of transport to school, 24.8% of students walked, 40% used bikes, 12% used cars, 19.2% used rickshaws, and 4.2% used other modes of transport. Of the students, 60.8% carried two-shouldered backpacks, 31.2% used one-shoulder bags, and 8.0% used trolley bags. Examination of specific backpack features showed that 65.2% of students had backpacks with waist belts, with 19.2% never using them, 9.6% using them occasionally, and 6.0% always using them. Chest straps were available to 12.4% of students, with 9.6% never using them, 33.2% using them sometimes,

type of bag is used to carry books and classroom to and from school



and 44.8% always using them. Furthermore, 58.4% of students reported not having wheels on their bags, while 25.2% never used wheels, 10.8% used them occasionally, and 5.6% always used wheels. Adjustable shoulder straps were reported as unavailable to 47.2% of students, with 19.6% never using them, 18.0% using them occasionally, and 15.2% always using them.

**Table 1: Distribution of Pain Location and Bag Carrying Posture Among Students**

Description	Frequency (%age)
<b>Pain Location</b>	
Muscle soreness	36 (14.4%)
Upper back pain	59 (23.6%)
Lower back pain	26 (10.4%)
Leg pain	40 (16.0%)
Neck pain	82 (32.8%)
Arm pain, tingling in arms/legs, other	7 (2.8%)
<b>Bag Carrying Posture</b>	
Always keep the bag away from the body	55 (22.0%)
Sometimes keep the bag away from the body	127 (50.8%)
Always go over the body while carrying a school bag	67 (26.8%)

The study categorized backpack weights into light (2-4 kg), medium (4-6 kg), and heavy (6-10 kg), with 27.2% of students carrying light bags, 64.4% carrying medium-weight bags, and 8.4% carrying heavy bags. Travel time to school showed that 30.8% of students spent less than 10 minutes, 48.0% spent 10-20 minutes, 19.2% spent 21-25 minutes, 1.6% spent 26-30 minutes, and 0.4% spent more than 30 minutes commuting. Among postural habits, 13.6% of students walked with their backpacks, 34.4% stood most of the time while carrying their bags, 27.6% stood occasionally, and 24.4% stood very little. Cell phone and computer usage revealed that 34.8% of students used devices for up to 2 hours daily, 47.6% for 3-4 hours, and 17.6% for 5 or more hours. The incidence of pain while carrying backpacks was notable, with 62.4% of students sometimes experiencing pain, 23.6% never experiencing pain, and 14.0% often feeling pain. Among students reporting pain, the distribution of pain locations included 14.4% with muscle soreness, 23.6% with upper back pain, 10.4% with lower back pain, 16.0% with leg pain, 32.8% with neck pain, and 2.8% with arm pain or tingling sensations in the arms or legs.

**Table 2: Association between back pain and category of the weight of the bag**

			Category of Weight of the Bag		
			Light (2-4 kg)	Medium (4-6 kg)	Heavy (6-10 kg)
Pain due to wearing your bag pack	Yes	Count	36	107	18
		% Within the Category of the weight of the bag	52.9%	66.5%	85.7%
	No	Count	32	54	3
		% Within the Category of the weight of the bag	47.1%	33.5%	14.3%

The study revealed an association between backpack weight and the likelihood of experiencing pain. Among students with light backpacks, 52.9% reported pain, whereas 66.5% of those with medium-weight bags and 85.7% of those with heavy backpacks reported experiencing pain. Conversely, 47.1% of students with light bags, 33.5% with medium bags, and 14.3% with heavy bags reported no pain, indicating a positive correlation between backpack weight and pain prevalence.

## DISCUSSION

In this study, responses from 250 out of 385 students highlighted a considerable prevalence of back pain associated with carrying heavy school bags. A higher percentage of students carrying heavy-weight bags (87.5%) reported back pain compared to those with medium-weight (66.5%) or lightweight bags (52.9%). This trend aligns with findings from Sharan et al., who noted that backache, especially low back pain, is a significant contributor to musculoskeletal issues at a young age due to the increasing load of academic materials (6). Students with heavy-weight bags in this study demonstrated a greater impact on back pain than those with lighter loads, reinforcing the association between increased backpack weight and musculoskeletal stress(25).

Talbott et al. reported that nearly all students aged 10 to 18 carried backpacks, with 83% wearing them over both shoulders, yet many still experienced pain due to poor backpack features or incorrect usage (26). Although dual-shoulder carriage can alleviate some strain, findings here showed that 60.8% of students used both shoulders but often lacked adjustable shoulder straps, with 47.2% reporting no use of these straps. Absence of adjustable straps may compromise ergonomic support and contribute to back discomfort, particularly when uneven loads cause postural imbalance. Literature suggests that single-shoulder backpack use predisposes students to lower back pain due to asymmetrical posture, corroborated by 64% of students in this study reporting back pain with backpack use. Similarly, research indicates asymmetrical bag carriage aggravates low back pain through postural deviation(27). This study also observed that perceived heaviness of a backpack may play a more critical role in causing discomfort than the actual weight, supporting findings in high school students from Kuwait, where subjective heaviness was significantly linked to back pain regardless of measured bag weight. For many students here, the burden of a perceived heavy backpack contributed to reported pain, particularly in the lower back(28, 29).

Data from Brzek et al. highlighted that 32% of children's backpacks exceeded recommended weights, underscoring a prevalent risk factor for discomfort and musculoskeletal issues in school-aged children (19). Comparably, this study found that 27.2% of student bags were categorized as light, 64.4% as medium-weight, and 8.4% as heavy, suggesting that a substantial proportion of students may be at risk of back pain if load distribution exceeds ergonomic recommendations(30). Literature suggests that a backpack exceeding 15% of an individual's body weight is significantly associated with low back pain, especially when carried for extended periods. Here, statistical analysis revealed a significant association between heavy-weight backpacks and back pain, with  $p = 0.015$ (29, 31). While these findings provide valuable insights, this study has limitations, including the relatively small sample size and limited geographic scope, which may affect the generalizability of results. Future studies would benefit from larger, diverse samples to assess variations in results across different settings(32). Despite these limitations, the study underscores the importance of appropriate backpack features and weight management for school-aged children, with potential implications for policy and school guidelines to mitigate musculoskeletal risks associated with heavy backpack use(26, 33).

## CONCLUSION

The findings indicate that carrying heavy backpacks is a significant factor contributing to low back pain among school-going children, placing undue stress on their shoulders and back muscles. This association highlights the need for awareness and intervention to mitigate the physical strain caused by excessive backpack weight. Future research could build upon these insights by exploring more comprehensive observational methods to better understand and address the musculoskeletal impacts of school bag use on children's health and quality of life.

Author	Contribution
Sana Sarwar	Conceptualization, Methodology, Formal Analysis, Writing - Original Draft, Validation, Supervision
Hafiz Muhammad Umar	Methodology, Investigation, Data Curation, Writing - Review & Editing
Rabia Ahsan	Investigation, Data Curation, Formal Analysis, Software
Shuja Uddin	Software, Validation, Writing - Original Draft
Muhammad Qasim	Formal Analysis, Writing - Review & Editing
Hafiz Muhammad Shiraz	Writing - Review & Editing, Assistance with Data Curation

## REFERENCES

1. Layuk S, Martiana T, Bongakaraeng B. School bag weight and the occurrence of back pain among elementary school children. *Journal of Public Health Research*. 2020;9(2):jp hr. 2020.1841.
2. Kafle S. Association of Backpack Weight with Musculoskeletal Status among Adolescents. 2020.
3. Bettany-Saltikov J, Cole L. The effect of frontpacks, shoulder bags and handheld bags on 3D back shape and posture in young university students: an ISIS2 study. *Research into spinal deformities 8*: IOS Press; 2012. p. 117-21.
4. Hoy D, Brooks P, Blyth F, Buchbinder R. The epidemiology of low back pain. *Best practice & research Clinical rheumatology*. 2010;24(6):769-81.
5. Hassan D, Kashif M, Bandpei MAM, Ali SQ, Raqib A, Manzoor N, et al. School bag packs and associated problems among school going children. *Physikalische Medizin, Rehabilitationsmedizin, Kurortmedizin*. 2020;30(01):10-6.
6. Sharan D, Ajeesh P, Jose JA, Debnath S, Manjula M. Back pack injuries in Indian school children: risk factors and clinical presentations. *Work*. 2012;41(Supplement 1):929-32.
7. Ibrahim AH. Incidence of back pain in egyptian school girls: effect of school bag weight and carrying way. *World Appl Sci J*. 2012;17(11):1526-34.
8. Mustafa IH, Ahmed SM, Alhagbaker JM, Al-Tawil N. ASSOCIATION BETWEEN WEIGHTS OF SCHOOLBAG WITH MUSCULOSKELETAL SYMPTOMS AMONG SAMPLE OF PRIMARY SCHOOL STUDENTS. *Gomal Journal of Medical Sciences*. 2024;22(1).
9. Hanif S, Altaf R, Bashir H, Rubab U. Frequency of Neck, Shoulder and Back pain due to Heavy Backpacks among Private School Children of Islamabad: A Descriptive Survey: Heavy Backpacks and Musculoskeletal Pain. *THE THERAPIST (Journal of Therapies & Rehabilitation Sciences)*. 2024:13-7.
10. Chalise GD, Sherpa S, Bharati M, Ambu K. Parental awareness about school backpack, weight carried by their children and related musculoskeletal problems. *Medical Journal of Shree Birendra Hospital*. 2020;19(2):97-102.
11. Afzal N, Asim H, Dilshad H. Frequency of Low Back Pain due to Heavy Bags among School-going Children in Lahore. *Pakistan*. 2015;4(4):1873-5.
12. Afzal N, Asim H, Dilshad H. Frequency of low back pain due to heavy bags among school-going children in Lahore, Pakistan. *Int J Sci Res*. 2015;4(4):2013-5.
13. Assiri A, Mahfouz AA, Awadalla NJ, Abolyazid AY, Shalaby M. Back pain and schoolbags among adolescents in Abha City, Southwestern Saudi Arabia. *International Journal of Environmental Research and Public Health*. 2020;17(1):5.
14. Gavela-Pérez T, Garcés C, Navarro-Sánchez P, López Villanueva L, Soriano-Guillén L. Earlier menarcheal age in Spanish girls is related with an increase in body mass index between pre-pubertal school age and adolescence. *Pediatric obesity*. 2015;10(6):410-5.

15. Ath-Thahirah AS, Utama AAGES, Indrayani AW, Kinandana GP. The usage and weight of backpacks are associated with shoulder pain complaints among elementary students. *Physical Therapy Journal of Indonesia*. 2024;5(1):61-5.
16. Ahmed NA, Ahmed NA, Narendran K, Shahid A, k Raj D, Kashyap N, et al. Examining the Backpack Weight Relative to Students' Body Weight Among Urban and Rural Schoolchildren: A Cross-Sectional Study. *Cureus*. 2024;16(4).
17. Akbar F, AlBesharah M, Al-Baghli J, Bulbul F, Mohammad D, Qadoura B, et al. Prevalence of low Back pain among adolescents in relation to the weight of school bags. *BMC musculoskeletal disorders*. 2019;20:1-9.
18. Natour J, Cazotti Lda, Ribeiro LH, Baptista AS, Jones A. Pilates improves pain, function and quality of life in patients with chronic low back pain: a randomized controlled trial. *Clinical rehabilitation*. 2015;29(1):59-68.
19. Brzęk A, Dworrak T, Strauss M, Sanchis-Gomar F, Sabbah I, Dworrak B, et al. The weight of pupils' schoolbags in early school age and its influence on body posture. *BMC musculoskeletal disorders*. 2017;18:1-11.
20. Noll M, Candotti CT, Rosa BNd, Loss JF. Back pain prevalence and associated factors in children and adolescents: an epidemiological population study. *Revista de saude publica*. 2016;50:31.
21. TOa A, ADa A, Ba O. Backpack Weight and Its Association with Musculoskeletal Pain and Trunk Mobility among Some Selected Secondary School Students. *pain*. 2023;15:3.91.
22. Sindhu Sankaran JJ, Patra SS, Das RR, Satapathy AK. Prevalence of Musculoskeletal Pain and Its Relation With Weight of Backpacks in School-Going Children in Eastern India. *Highlights in Musculoskeletal Pain 2021/22*. 2023;16648714.
23. Quartey J, Baidoo NAB, Kwakye SK, Ahenkorah J. Association between bag weight, carrying style and low back pain and spinal curvatures among school children in Accra, Ghana. *Journal of Preventive and Rehabilitative Medicine*. 2023;5(1):52-9.
24. Ghorpade NA, Koli C. Backpack associated musculoskeletal problems in school going Indian children. *NeuroQuantology*. 2023;21(6):728.
25. Sundas R, Ghous M, Sehar S. Association of backpack loads and wearing time with musculoskeletal disorders in school children of Wah Cant Pakistan: Correlational study. *International Journal of Clinical and Medical Education Research*. 2022;1(1):1-6.
26. Talbott NR, Bhattacharya A, Davis KG, Shukla R, Levin L. School backpacks: it's more than just a weight problem. *Work*. 2009;34(4):481-94.
27. Santos EDS, Bernardes JM, Noll M, Gómez-Salgado J, Ruiz-Frutos C, Dias A. Prevalence of low back pain and associated risks in school-age children. *Pain Management Nursing*. 2021;22(4):459-64.
28. Sankaran S, John J, Patra SS, Das RR, Satapathy AK. Prevalence of musculoskeletal pain and its relation with weight of backpacks in school-going children in Eastern India. *Frontiers in Pain Research*. 2021;2:684133.
29. Kędra A, Plandowska M, Kędra P, Czaprowski D. Non-specific low back pain: Cross-sectional study of 11,423 children and youth and the association with the perception of heaviness in carrying of schoolbags. *PeerJ*. 2021;9:e11220.
30. Ogana SO. Ergonomic and Sociodemographic Factors as Predictors of Bag-Use Related Musculoskeletal Pain among School Going Children.
31. Shuhaimi SA, Rahman HA. Association between schoolbag weight and back pain among primary schoolchildren in kajang, selangor. *Malaysian Journal of Public Health Medicine*. 2020;20(Special1):77-82.
32. Brackley HM, Stevenson JM. Are children's backpack weight limits enough?: A critical review of the relevant literature. *Spine*. 2004;29(19):2184-90.
33. Lopez Hernandez T, Caparo Ferre M, Gine Marti S, Salvat Salvat I. Relationship between school backpacks and musculoskeletal pain in children 8 to 10 years of age: an observational, cross-sectional and analytical study. *International journal of environmental research and public health*. 2020;17(7):2487.